REMARKS

Claims 1-17 remain in the application and have been amended hereby.

As will be noted from the Declaration, Applicants are citizens and residents of Japan and this application originated there.

Accordingly, the amendments made to the specification are provided to place the application in idiomatic English, and the claims are amended to place them in better condition for examination.

An early and favorable examination on the merits is earnestly solicited.

Respectfully submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE
IN THE ABSTRACT OF THE DISCLOSURE

Please amend the Abstract by rewriting same to read as follows.

An audio signal processing apparatus and method using pitch information to change a length of predictive residual signals while maintaining continuity and thereby enabling conversion of a reproduction speed without changing a pitch and enabling a conversion of speed [by] with a [small amount] minimum of calculation, [comprising] includes shortening or extending residual signals on a time axis while maintaining pitch information, cutting out signals and connecting [of] different pitch sections in the respective frames based on a mutual resemblance of signals at the time of shortening, and extending predictive residual signals in respective frames by extrapolation at the time of extension. An audio signal that has been compressed or expanded on the time axis can be reproduced without changing the pitch by synthesizing an audio signal by [an LPC] a linear predication code synthesis filter based on the generated new predictive residual signals.

IN THE CLAIMS

Please amend claims 1-17 by rewriting same to read as follows.

--1. (Amended) An audio signal processing apparatus for reproducing an audio signal by decoding encoded predictive residual signals produced by forward prediction on a frame by frame basis, the apparatus comprising:

[an] excitation source modifying means for extending or shortening said predictive residual signals on a time axis; and

[a] synthesizing means for synthesizing an audio signal based on predictive residual signals converted by said excitation source modifying means.

--2. (Amended) [An] The audio signal processing apparatus as set forth in claim 1, wherein said excitation source modifying means [comprising] comprises:

first dividing means for dividing said predictive residual signals into a plurality of sub-frames based on a pitch;

second dividing means for dividing a signal of [a] sub-frames into a first signal [whose] having a length [is] m (where m is an integer and m<L, where L is the length of said sub-frame) and [the remaining] a second signal [whose] having a length [is] (L-m) as a reference signal;

finding means for finding [the closest] a signal [of] closest to said reference signal from an other sub-frame,

wherein said excitation source modifying means shortens said predictive residual signals by concatenating the first signal and the closest signal.

--3. (Amended) [An] The audio signal processing apparatus as set forth in claim 2, wherein said finding means calculates cross-correlation values with said reference signal for [signal] signals of said other sub-frame, takes out a signal as the closest signal from a position where the calculated cross-correlation value becomes the largest.

--4. (Amended) [An] The audio signal processing apparatus as set forth in claim 2, wherein said finding means calculates a square error with said reference signal for [signal] signals of said other sub-frame[,] and takes out [signals] a signal as the closest signal from a position where the calculated square error becomes the smallest.

--5. (Amended) [An] The audio signal processing apparatus as

set forth in claim 1, wherein

said excitation source modifying means extends said predictive residual signals by a [certain] predetermined extension rate by finding a signal having a predetermined length from the end of the predictive residual signals of a frame; and

concatenating said signal after the end of the predictive residual signals to [generates] generate extended predictive residual signals.

--6. (Amended) [An] The audio signal processing apparatus as set forth in claim 1, wherein said synthesizing means [is] comprises a linear prediction code synthesis filter.

--7. (Amended) An audio signal processing apparatus for reproducing an audio signal by decoding encoded predictive residual signals produced by forward prediction on a frame by frame basis, the apparatus comprising:

[an] excitation source modifying means for shortening the predictive residual signals by taking out a first signal [from signal] in a sub-frame of the predictive residual signals and a second signal [from signal] in a following sub-frame based on cross-correlation while maintaining [the] a pitch, or for extending the predictive residual signals by connecting data estimated by extrapolation to signals of a frame while maintaining the pitch, and

[a] synthesizing means for synthesizing an audio signal based on predictive residual signals converted by said excitation source modifying means.

--8. (Amended) [An] The audio signal processing apparatus as set forth in claim 7, wherein said excitation source modifying

means [comprising] comprises:

dividing means for dividing a signal of said sub-frame into [the] a first signal [whose] having a length [is] m (where m is an integer and m<L, where L is the length of said sub-frame) and [the remaining] a second signal [whose] having a length [is] (L-m) as a reference signal;

finding means for finding [the closest] a signal [of] closest to said reference signal from [the] an other sub-frame,

wherein said excitation source modifying means shortens said predictive residual signals by concatenating the first signal and the closest signal.

--9. (Amended) [An] The audio signal processing apparatus as set forth in claim 8, wherein

said excitation source modifying means comprises:

[a] first multiplying means for multiplying said reference signal by a first window function;

[a] second multiplying means for multiplying signal taken out from said other sub-frame by a second window function; and

[an] adding means for adding results of said first and second multiplying means[; and].

wherein said excitation source modifying means concatenates [the] results of said adding means after the first signal taken out from said sub-frame to generate one pitch worth of new predictive residual signals.

--10. (Amended) [An] The audio signal processing apparatus as set forth in claim 8, wherein said finding means calculates cross-correlation values with said reference signal for a signal of said other sub-frame[,] and takes out a signal as the closest signal from a position where the calculated cross-correlation value

becomes the largest.

--11. (Amended) [An] The audio signal processing apparatus as set forth in claim 8, wherein said finding means calculates a square error with said reference signal for a signal of said other sub-frame[,] and takes out a signal as the closest signal from a position where the calculated square error becomes the smallest.

--12. (Amended) [An] The audio signal processing apparatus as set forth in claim 7, wherein said excitation source modifying means extends said predictive residual signals by a [certain] predetermined extension rate by finding a signal having a predetermined length from the end of the predictive residual signals of a frame; and concatenating said signal after the end of the prediction residual signals to [generates] generate extended predictive residual signals.

--13. (Amended) [An] The audio signal processing apparatus as set forth in claim 7, wherein said synthesizing means [is] comprises a linear prediction code synthesis filter.

--14. (Amended) An audio signal processing method for extending or shortening predictive residual signals on a time axis in decoding [of] a signal encoded by forward prediction on a frame by frame basis, comprising the steps of:

processing for shortening the predictive residual signals by taking out a first signal [from signal] in a sub-frame of the predictive residual signals and a second signal [from signal] in a following sub-frame based on cross-correlation while maintaining [the] a pitch or for extending the [previous] predictive residual signals by connecting data estimated by extrapolation to signals of

a frame while maintaining the pitch so as to shorten or extend the signals of one frame, and

processing for synthesizing an audio signal based on [such] said shortened or extended predictive residual signals.

--15. (Amended) [An] The audio signal processing method as set forth in claim 14, [further comprising] wherein the step of shortening said predictive residual signals [by] includes:

dividing a signal of said sub-frame into [the] a first signal [whose] having a length [is] m (where m is an integer and m<L, where L is the length of said sub-frame) and [the remaining] a second signal [whose] having a length [is] (L-m) as a reference signal;

finding [the closest] a signal [of] closest to said reference signal from [the] an other sub-frame; and

concatenating the first signal and the closest signal.

--16. (Amended) [An] The audio signal processing method as set forth in claim 15, further comprising shortening said predictive residual signals by

first multiplication processing for multiplying said reference signal by a first window function;

second multiplication processing for multiplying a signal taken out from said other sub-frame by a second window function; and

adding processing for adding results of said first and second multiplying means and

concatenating the results of said adding processing after the first signal taken out from said sub-frame to generate one pitch worth of new predictive residual signals.

--17. (Amended) [An] The audio signal processing method as set forth in claim 14, further comprising extending said predictive residual signals by a [certain] predetermined extension rate by finding a signal having a predetermined length from the end of the predictive residual signals of a frame; and concatenating said signal at the end of the predictive residual signals to [generates] generate extended predictive residual signals.